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The ILLUMINATING ENGINEER

ELECTRICITY · ACETYLENE · OIL · GAS

Edited by LEON GASTER

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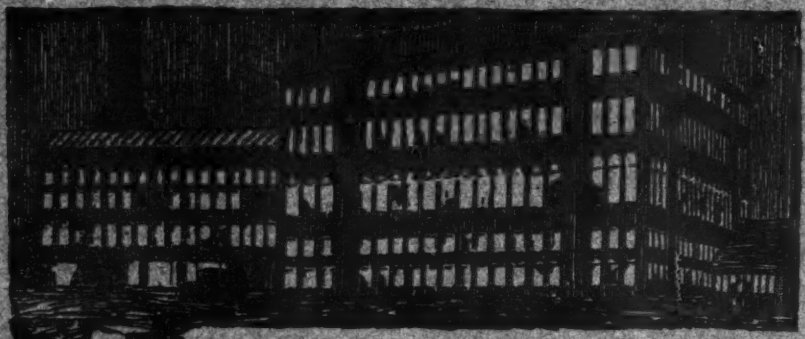
OFFICIAL ORGAN OF THE
Illuminating Engineering Society.
(Founded in London 1909.)

ILLUMINATING ENGINEERING PUBLISHING COMPANY, LTD.
32, VICTORIA STREET, LONDON, S.W.1
(TEL. NO. VICTORIA 5215.)

This number contains an Account of the Opening Meeting of **The Illuminating Engineering Society** on November 13th, 1923, when **Reports of Progress** were read, and various **Novel Lamps** and **Lighting Devices** were exhibited.

Also the paper entitled "**Some Applications of Illuminating Engineering in Practice,**" by Messrs. G. HERBERT and R. A. IVES, read before the Society on December 11th, 1923, and the ensuing discussion.



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Communications addressed to the Chief Office, Horseferry Road, Westminster, S.W.1, and mentioning "The Illuminating Engineer," will receive special attention.

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EDITORIAL.

The Illuminating Engineer, 1908-1924—Its Future Development.

The present issue completes the sixteenth volume of THE ILLUMINATING ENGINEER, which made its first appearance in January, 1908. The Illuminating Engineering Society was founded in the following year and the journal has since acted as its official organ. At that time the term "illuminating engineering" was new and unfamiliar. One of the first tasks of the journal was to show what a variety of subjects are included under this heading, thus paving the way for the Society's work, and afterwards giving expression to it.

When the idea was first suggested there were some who could not conceive how rival systems of lighting could be dealt with in a journal receiving the aid of those associated with them. It has been shown, however, that every system must stand on its merits, and that in the long run all benefit from the existence of a platform where the possibilities of every system can be demonstrated. Even more important is the recognition that the principles involved in the application of light are common to all illuminants, and that there are many problems of common interest, where the efforts of rivals can be united.

The other chief alleged difficulty was the fear that there would be a dearth of material to discuss! Reviewing the great variety of topics that have been dealt with during the past sixteen years, one can only wonder

how such an idea could exist. The difficulty has been, not to find subjects, but how to find room for reference to the constantly increasing developments in all parts of the world.

From the first progress was rapid. But the outbreak of war came at an unfortunate time, and the maintenance of continuity of work during this period imposed a great burden, and left a legacy of difficulties in its train. These circumstances led to some unavoidable delay in publication, and it was found expedient to deal with arrears by the occasional publication of issues covering a longer period and bringing matter up to date.

We have now reached an interesting stage of development of illuminating engineering. Up to now we have been engaged largely on a career of self-education, but the main principles of good illumination have been crystallised. Attention has been devoted mainly towards bringing the subject before the notice of experts, and securing the co-operation of Government Departments, Public Authorities and kindred associations. In this way many channels for joint effort by experts and users of light have been created. Joint Committees have been formed to deal with many types of problems, and to work out lighting requirements in detail. Valuable machinery has been created, and in the future we should reap the reward of all this pioneering work.

Experience has shown that the public is becoming alive to the need for guidance from those in a position to present authoritative, simple and definite information. Hitherto it was necessary to address ourselves primarily to those best able to share in constructive pioneering work. Now we are in a position to present unbiassed and definite results.

All these considerations have led to the conclusion that the time is ripe for an effort to broaden the basis of the illuminating engineering movement. From several quarters the suggestions have been conveyed to us that the journal should be enlarged so as to make a wider appeal, not only in this country but in the Colonies and Dominions. Steps in this direction are being considered. The aim will be to extend the sphere of influence of the journal by the inclusion of matter appealing to a wider section of the public; and in particular to include practical data of interest to those associated with gas and electric supply concerns, electrical contractors and others by whom the actual carrying out of lighting installations is done.

These changes have been approved by the Council of the Illuminating Engineering Society and, it need not be said, will not involve any departure from the scientific and impartial attitude with which the ILLUMINATING ENGINEER has been identified. Scientific data, presented at meetings of the Illuminating Engineering Society will still form the leading feature. But there will be more readable matter as well. One of the first steps will be the enlargement of the section dealing with practical developments, more attention will be given to notable lighting installations, interesting applications of light, and news from abroad.

In making these changes we rely on the co-operation of our readers, and on greater financial support from all sections of the lighting industry, which derives direct benefit from the movement. The establishment of the illuminating engineering movement on a firm basis, the insurance of its future prosperity, is a matter of national importance. This country, the first in Europe to form an Illuminating Engineering Society, has attained a leading position in regard to the use of light as an aid to health, safety and efficiency. Now that the movement is spreading in all directions renewed efforts are needed in order that this country may not fall behind.

Progress in Illuminating Engineering and its Applications.

The recent meetings of the Illuminating Engineering Society dealt with in this issue aptly illustrate two different aspects of illuminating engineering. The opening meeting was, as is customary, devoted to reports of progress and the display of novelties in the way of lamps and lighting appliances; the second to the application of illuminating engineering in practice and especially the best methods of influencing the public and inducing them to appreciate the benefits of proper methods of lighting. As usual, the exhibits at the opening covered a wide field. New forms of gasfilled lamps, the use of colour for decorative purposes, a special form of motor headlight, and developments in illuminated signs were amongst the topics dealt with. There can be no question that in technical applications of light steady and continual progress is being made.

Messrs. G. Herbert and R. A. Ives, in dealing with the problem of securing popular support for illuminating engineering mentioned some experiences of makers of lamps and lighting appliances in approaching users. In common with others who joined in the discussion they drew attention to the great change in public outlook since the Society commenced its work in 1909. There can be no question that much more importance is attached to good lighting than in the past. One of the chief needs at the present moment is the compilation of data, *e.g.*, illustrating the relation between inadequate lighting and accidents, and the advantages of good illumination in removing handicaps to efficient production.

It was generally agreed that data of this kind, in order to carry conviction, must be obtained by an independent and impartial body, representing both the expert and the user of light. This is in fact just the kind of work that the Illuminating Engineering Society should do in the interests alike of the public and the lighting industry, and which it is trying to do at the present time. The need for an authoritative ruling is equally evident in such problems as the determination of lighting requirements of various industries. It is common experience that great variation of opinion in regard to lighting exists in many industries. The work of advisers would be much simplified if they could quote an authoritative opinion as to the conditions of illumination desirable. This, again, is the kind of task for which the Illuminating Engineering Society is specially well fitted, and can undertake with the aid of the Special Committee on Illumination working under the Department of Scientific and Industrial Research, and receiving the assistance of physiologists, architects, etc., as well as experts on lighting.

We gladly recognise the value of the educational work done by several of the leading firms in the lighting industry in the course of their contact with the public. The demonstrations now being arranged should bear good fruit if devised to bring home the fundamental principles of good lighting with which the Society is identified. This is a most useful form of propaganda provided the views expressed are in accordance with the recommendations of the Illuminating Engineering Society and the Research Committee mentioned above.

But there are other forms, in particular in relation to Government Departments, Public Authorities, etc., which are not readily undertaken by commercial concerns and it is here that the Society's efforts are needed.

The Island of Guernsey.

The island of Guernsey, which was recently visited by a party of 24 members of the British International Association of Journalists, as guests of the Guernsey Chamber of Commerce, deserves to be numbered amongst the most delightful holiday resorts easily accessible from London. Whilst English is spoken everywhere and one has no sensation of being in a foreign land, the island has customs and traditions of very long standing quite distinct from those in the rest of the British Isles, and also a more genial climate. Further, inhabitants are fortunate in being called upon to pay practically no income tax, whilst local rates and import duties are negligible.

The island is a striking illustration of the combination of industrial pursuits and agreeable scenery. There are many delightful walks among the cliffs fringing the southern shore, a pleasantly situated golf-links and grass and hard lawn-tennis courts. But in the interior of the island, its main industry—the growing of fruit and vegetables—is much in evidence, and there are local quarries from which exceptionally fine and hard granite is exported.

Guernsey, unlike its sister island Jersey, possesses both gas and electric supply. Both undertakings have had to struggle with early difficulties but are now doing well. To engineers the problems involved in laying pipes up steep and tortuous streets should be of interest. The streets are lighted at present mainly by gas, whilst electricity is used largely for interior lighting. Judging by the standards of a city like London the lighting of the shop windows and the illumination of the streets strikes one as hardly sufficiently generous, but the standard is naturally different from that of a crowded industrial area, and considerable progress has been made during recent years. The arrangements for the coast-lights are also worth noting, particularly the lighthouse at St. Martin's Point, where the gasfilled lamps are controlled electrically from the harbour at St. Peter's Port.

In St. Peter's Port there is a distinctive and well arranged museum and a library containing many scarce books of historical interest. In the Société Guernsiaise the island possesses a body keenly interested in scientific and antiquarian pursuits, by whom information regarding the history and folk-lore of the island is zealously collected. During our visit we were privileged to hear a lecture by Miss Edith Carey, a local historian of repute, who gave us some insight into the curious traditions and beliefs that still exist in these islands.

Visitors to Guernsey, besides enjoying a holiday in a tranquil atmosphere and pleasant surroundings, will thus find much of intellectual interest. By the aid of motor-boats the grand cliff scenery of Sark, and the curious shell-beach (a scientific curiosity) in the adjacent island of Herm may be visited. In fine weather there is also the recently developed flying boat service, which reduces the journey from Southampton about 2¼ hours and undertakes pleasure cruises over the islands.

It only remains to add that during our stay we were entertained by the Guernsey Chamber of Commerce at the Royal Hotel in a most hospitable manner and given every opportunity of studying the resources of Guernsey. Acknowledgment should also be made of the courtesy of the Southern and Great Western Railways in granting free return passes, and doing everything possible to promote the comfort of the party during the journey.

LEON GASTER.

TRANSACTIONS

OF

The Illuminating Engineering Society.

(Founded in London, 1909.)

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

PROGRESS IN ILLUMINATING ENGINEERING.

(Proceedings at the Opening Meeting of the Illuminating Engineering Society held at the House of the Royal Society of Arts, 18, John Street, Adelphi, W.C., at 8 p.m., on Tuesday, November 13th, 1923.)

THE Opening Meeting of the Illuminating Engineering Society was held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 8 p.m. on Tuesday, November 13th, the Chair being taken by Mr. L. GASTER.

The Minutes of the last Meeting having been taken as read, the HON. SECRETARY announced the names of the following applicants for Membership :—

P. BAX	Consulting Engineer, Spath Lodge, Didsbury, Manchester.
J. DOAK	Burgh Lighting Inspector, 3, Jamaica Street, Greenock, Scotland.
M. MAURICE	Mining Engineer, Park Grange, Sheffield.
P. D. MORRIS	Electrical Engineer, St. Merryn, 51, Harlech Street, Southgate, London, N.14.
J. M. WALDRAM ..	General Electric Co., Ltd., Illuminating Engineering Department, Magnet House, Kingsway, W.C.

The HON. SECRETARY then proceeded to present his report on **"Notes on Events during the Vacation,"** referring, amongst other matters, to the attention being devoted by the Home Office, in co-operation with leading joint Industrial Councils, to industrial lighting, and the formation by the Department of Scientific and Industrial Research of a Committee on Illumination which it was hoped would be able to deal with several outstanding problems of practical importance and interest to the Society.

Following this address Mr. A. CUNNINGTON gave a brief account of **Tests of Railway Lighting** being undertaken for the Joint Committee of the Society concerned with this subject; and the Report of the Committee on **Progress in Electric Lamps and Lighting Appliances** was read (in the absence of the Chairman) by Mr. J. S. DOW. The report referred to the progress being made in co-operation between makers of lamps and fittings manufacturers and the efforts now being made to arrange demonstrations of lighting for the benefit of the general public. During the past year there had been steady progress in the design of fittings and a new method of spraying lamp bulbs in order to obtain good diffusion of light has been introduced.

Mr. J. G. CLARK then gave an address on the aims and objects of the **National Gas Exhibition** and progress in gas lighting

illustrated by the exhibits. Attention was drawn to the advance in the production of inexpensive but efficient burners, the use of silica ware for shades, improved types of fittings, including those for semi-indirect lighting, standardisation and propaganda work.

Mr. PHILIP SUGG also gave a summary of recent advances in fixture design, showing diagrams of some compact forms of burners and semi-indirect lighting units, and explaining modern methods of distance control.

Mr. L. E. BUCKELL next gave a demonstration of some of the latest forms of **electric lamps,** including several large candlepower types, taking 3 and 4 k.w. An interesting item was the display of lamps with bulbs sprayed with a new kaolin material, giving good diffusing properties and easily cleaned.

Miss BEATRICE IRWIN described the **Irwin Colour Filter System of Illumination** and exhibited a number of pleasing lighting units, chiefly cylinders of special paper tinted by hand with various colours. Capt. E. STROUD exhibited some new Holophane fittings, in which coloured films are applied to the bulbs of lamps used in the glassware giving striking colour-effects suitable for decorative lighting.

Mr. E. GREETHAM operated the new **Ediswan Pointolite Lamp** which has been designed for use on alternating current, and Mr. E. T. RUTHVEN MURRAY showed some of the latest examples of "Internalite" **illuminated signs.** Finally a demonstration was given of a **new form of motor-car headlight** devised by Mr. H. WORKMAN, which confined the beam strictly below a horizontal plane and was simple in design and application.

After a vote of thanks had been passed to the various speakers and exhibitors the Chairman announced that the **next meeting** would be held on December 11th when a discussion on "**Some Applications of Illuminating Engineering in Practice**" would be opened by Mr. GEO. HERBERT and Mr. R. A. IVES.

NOTES ON EVENTS DURING THE VACATION.

By L. GASTER (Hon. Secretary).

(Presented at the Opening Meeting of the Illuminating Engineering Society held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 8 p.m., on Tuesday, November 13th, 1923.)

IT is customary at the opening meeting of the session to give some account of progress during the vacation. Before proceeding to do so, however, I wish to refer to several losses which illuminating engineering has recently sustained. The passing away of Dr. Louis Bell on June 14th has already been noted in the official journal. Dr. Bell was one of the very earliest in the United States to identify themselves with illuminating engineering. His brilliant and versatile gifts were known to many members of our own Society, in which he took a keen interest, and of which he was created a Vice-President. We have also to record with regret the death of Mrs. Ayrton, whose name will always be associated with her pioneering researches on the electric arc, and Dr. C. P. Steinmetz whose work, like that of Dr. Bell, was almost as well known in this country as in America.

Industrial lighting, which was the subject of special reference in the Annual Report of the Council in May, continues to arouse attention. The Report of H.M. Inspector of Factories for 1922 refers to the useful work being done in consultation with several of the leading Joint Industrial Councils, notably that concerned with the hosiery trade. A good example of such work is to be found in the paper on illumination read by Mr. D. R. Wilson at a meeting called by the Joint Industrial Council for the pottery trades early this year. The address, which dealt with principles of

industrial lighting in quite a simple manner, was much appreciated, and the discussion was most useful in suggesting how the requirements of this particular industry can be met in practice. The Report of H.M. Chief Inspector of Factories mentions cases of improved results obtained in installations following the removal of "glaring" conditions, and refers to the investigations now in progress with the object of tracing the relation between inadequate illumination and accidents. The latter point was also commented upon by many of the speakers at the recent Annual Meeting of the London District of the British Industrial "Safety First" Association. The illustrated pamphlet prepared by the writer on "Good Lighting as an Asset to Safety" has now been completely revised and will shortly be issued in an extended form.

The drawbacks of glare in industrial lighting were well illustrated by Dr. G. H. Miles, of the National Institute of Industrial Psychology, in a paper before the British Association. Some instructive experiments on the effects of exposure of the eye to unscreened bright sources on accuracy of work were described, and the general conclusion was drawn that the full benefits of higher illumination are only realised when glare is eliminated.

It will be recalled that in previous reports reference has been made to the attention now being devoted to industrial lighting by the Department of Industrial Hygiene of the International Labour Bureau of the League of Nations in Geneva. The investigations of the Department have now found form in a very comprehensive report on the effect of light on the eye, with special reference to factory lighting. An English version of this report is in preparation and will be issued shortly.

An event of considerable interest has been the appointment by the Department of Scientific and Industrial Research of a Committee on Illumination, whose functions are:—"(A) to consider and advise on requests from other departments for investigations in connection with the lighting of buildings and allied problems, and to supervise such investigations if approved by the Advisory Council; (B) to co-operate with the Medical Research Council by making arrangements for and supervising physical investigations needed in connection with physiological researches on illumination; (C) to examine the need for general researches on illumination, to make such recommendations to the Advisory Council as they may consider desirable, and to undertake the supervision of approved investigations."

The wide terms of reference of the Committee should enable it to deal with many outstanding problems of great practical importance and interest to the Society. The constitution of the Committee is as follows:—Mr. C. C. Paterson (Chairman), Sir John Herbert Parsons, Mr. D. R. Wilson and Dr. H. Hartridge (Medical Research Council), Mr. J. W. T. Walsh (National Physical Laboratory), Mr. L. Gaster (Illuminating Engineering Society), Dr. J. S. G. Thomas (South Metropolitan Gas Company), Messrs. Alban Scott and S. B. Russell (Architects), Mr. S. C. Bromley (Secretary).

The National Illumination Committee has added to its useful work on definitions of photometric quantities a tentative table of symbols, selected with a view to unifying existing practice and avoiding confusion with other international symbols. In most cases the symbols suggested are already widely used. The chief departure is the selection of "J" for candlepower, a choice determined by the fact that "I" already figures as the international symbol for electric current.

It is proposed that the next Technical Session of the International Illumination Commission will be held in Geneva in July next year. About the same time there is also to be a conference dealing, among other matters, with industrial lighting, arranged by the International Labour Bureau of the League of Nations. This should prove a very convenient occasion for reviewing international progress in the lighting of factories and workshops.

The papers presented at the Seventeenth Annual Convention of the American Illuminating Engineering Society during September 24-28 show considerable variety. The review of progress is this year particularly comprehensive and contains many interesting items of information collected both from Europe

and the United States. During the past year no very outstanding advance in illuminants has taken place, but there is evidence of increasing activity in experiment, especially in lamps depending on luminescence of conducting vapours. It is stated that carbon filament lamps now form only 1·5 per cent. of the total produced in the United States, and an attempt is made to tabulate the number of lamps used per capita in America and the chief countries of Europe. Attention is drawn to the wider recognition being given to data on the intensity of illumination for various forms of interior lighting. The same method is now being applied to public lighting and a table has been drawn up for streets in cities having up to 100,000 population.

The National Gas Exhibition at Birmingham is to be the subject of a special address to-night and I need not therefore do more than mention this as an illustration of developments in gas lighting. A feature during the present year has been the increased interest taken by many gas concerns in lighting, as well as heating, and illumination was fully represented in the exhibits, as well as in the papers delivered. A keynote of many addresses has been the necessity of giving good service to the consumer, and recognition of the value of propaganda work of a wide educational kind amongst the general public.

Lastly, I wish to refer to two developments in this country which illustrate the spread of interest in illumination and give an encouraging indication of the general desire for information on lighting matters.

There is first the step that has been taken to form an Association of Public Lighting Engineers, under the Presidency of Mr. S. B. Langlands, Public Lighting Inspector of Glasgow. There can be no doubt that much remains to be done to improve the lighting of many cities throughout the country. The efforts of the new body should form a useful supplement to the work of the Illuminating Engineering Society which has, for many years, consistently striven to arouse public interest in this problem. The development of the new body will be watched with interest, and no doubt there will be useful opportunities for the two bodies to co-operate in their common aim of securing better street lighting conditions.

It has also been interesting to observe the manner in which some of the leading makers of lamps and lighting appliances are organising demonstrations of illumination for the benefit of the general public. There could not be a better illustration that illuminating engineering has come to stay than this recognition that up-to-date firms must be willing to give "service"—not merely to supply goods but to show people how they should be used. Leading firms in the lighting industry are in a position to do much useful educational work, by presenting in a popular form the chief principles endorsed by the Society, and making use of the large amount of data originating in its discussions. Naturally unity of effort on the part of firms embarking on such propaganda is desirable, and it has accordingly been suggested that such efforts should be under the supervision of a small committee, composed of members of the Society who are also associated with the leading manufacturing firms. A nucleus already exists in the Committee on Progress in Lamps and Lighting Appliances which is furnishing its usual annual report at this opening meeting. The present moment is opportune for extending the circle of those to whom illuminating engineering appeals and there are openings for all those concerned with different aspects of the subject to take part in this educational movement.

It is also felt that the time is ripe to make some modifications in the arrangement of THE ILLUMINATING ENGINEER, in order to increase its sphere of usefulness. In particular it is proposed to extend the "Topical and Industrial Section" so as to make this part of the journal more readable and interesting to electrical contractors, managers of factories and other large users of light. The journal will thus continue to serve the purpose of recording the work of the Society, of which it is the official organ, but it will also contain a popular section and thus enable illuminating engineering to be brought before the notice of a wider section of the public.

THE POSITION OF THE METAL FILAMENT LAMP AND FITTINGS INDUSTRY AT THE PRESENT TIME.

(Report of the Committee on Progress in Electric Lamps and Lighting Appliances—Mr. S. H. Callow (Chairman), Mr. C. W. Sully, Mr. J. W. Elliott (Secretary), Mr. J. Y. Fletcher—presented at the opening Meeting of the Society, held at the House of the Royal Society of Arts, 18, John Street, Adelphi, W.C., at 8 p.m., on Tuesday, November 13th, 1923.)

THE year 1922-23 has seen a reasonable increase in the sale of both electric lamps and fittings and scientific reflectors for use with same.

One of the most important developments has been the co-operation amongst the leading manufacturers to develop illumination on scientific lines, whereas in the past lamps and lighting appliances have been sold as separate units, very often without any pre-determined knowledge as to the result when the two were used together.

The whole question of scientific illumination is now engaging the attention of both lamp and fittings manufacturers, their aim being to reach standardisation both in the case of lamps and fittings, so that definite results with any given unit can be guaranteed to the user.

In the future, opportunities will be afforded to the engineer and also to the general public of calling at the demonstration rooms of the manufacturers where lighting units for every purpose will be demonstrated exactly under the same conditions as those under which the consumer will be using them. In addition to the consumer being able to see the general lighting result which would be produced by any given scheme, he will be able to see the resultant foot-candles over any particular area, and will thereby be sure that he is obtaining at least the minimum value which experience has shown to be necessary for any particular operation or class of work.

The question of standardisation has also been pursued in other directions, particularly in connection with the automobile trade, and during the past eight months the British manufacturers of electric lamps have agreed with the leading manufacturers of lighting sets and headlights to furnish ten standard lamps which will cover the range of all British cars. These lamps will be stamped with the letters "B.A.S." (British Automobile Standard) and will, therefore, be readily identified by the public as being suitable for their requirements and designed on scientific lines to the correct focal position, etc., for their particular equipment.

During this year, there has been an increasing demand for gasfilled lamps in opal bulbs and a further type of lamp has now been introduced on these lines, *i.e.*, the sprayed lamp. This lamp is at present being supplied to give a white opal finish, but in the future will also be supplied sprayed in various colours to harmonise with any particular style of decoration.

Many developments have also taken place in the designing of fittings and reflectors of both the metal and glass type, and there are now quite a variety of reflectors on the market which in addition to being scientifically designed to produce the maximum illumination in any required direction, are also of decorative design and are produced in sufficient variety to harmonise with most styles of decoration.

RAILWAY LIGHTING.

MR. A. CUNNINGTON dealt briefly with the work of the Railway Lighting Committee and gave some particulars of the tests carried out. The work had so far been confined to the lighting of platforms of the second class, *i.e.*, important junction stations with considerable traffic, but not quite up to the standard of terminal stations. A large number of measurements had been made on typical installations both of gas and electric lighting. The work had been somewhat handicapped by the inability of the Society to provide an official tester, but co-operation between representatives of the Society and Technical Assistants of the various railways had enabled them to obtain the results referred to. The importance

of platform lighting from the point of view of the safety of the passenger was manifest. It was hoped in future to deal with carriage lighting which was of primary importance in connection with the comfort of the passenger and later on with the lighting of shunting yards, which latter had been somewhat covered by the work of the Home Office Committee on Factory Lighting.

PROGRESS IN GAS LIGHTING.

MR. J. G. CLARK gave a review of progress in gas lighting, as illustrated at the National Gas Exhibition. A feature of the exhibition was the activity shown by British burner manufacturers. They had demonstrated that it was possible to produce a gas burner which, although simple and cheap, was thoroughly scientific and efficient. It seemed that the days of the cheap and nasty burner were numbered and there was every reason to believe that the gas industry could look forward to the early elimination of this impediment to the fullest development of gas lighting.

Further progress was also to be recorded in the use of silica-ware. The art of fashioning and tinting this material was now practically mastered, and he felt confident in predicting for it a great future in the field of gas lighting. Renewed interest had also been shown in the development of gas fittings. Their production in high class style and on a scale that meant low cost of manufacture showed confidence in the future of gas lighting. There seemed also to be a growing popular interest in semi-indirect lighting, and some ingenious contrivances had been designed in order to meet this demand. Standardisation was also receiving attention and this should have a good effect.

The establishment of the Therm method of charging was to be regarded as a definite step forward, which had already had a beneficial effect on the design of gas appliances. Lighting efficiency was already being expressed in terms of heat units consumed per unit of light emitted, and he hoped that before long this method would become universal.

There was some promise of new developments in regard to mantles but nothing definite could be reported so far. Mantle manufacturers were keenly interested in research on their products, as was shown by the introduction of a new testing machine whereby the tensile strength of mantles could be scientifically studied.

The resources of science were being more and more applied in the gas industry and a number of new and improved measuring instruments had been evolved. Research has been in progress in Leeds University for some years and had recently been supplemented by the establishment at the Imperial College of Science of a Studentship.

The reports of the Home Office Departmental Committee on Lighting in Factories and Workshops had been watched with interest by all concerned with the use of gas for industrial lighting. They recognised that if the proposals were applied in a commonsense manner they could do nothing but good to all concerned. Gas engineers were fully alive to the importance of this matter and had spared no efforts in the past to set themselves a high standard; nor would they in the future relinquish their efforts to do better.

In street lighting the so-called cluster-burner was finding favour. It might be recalled that these units consisted of a burner head having two or more flame outlets. The mantles might be arranged symmetrically about a centre, or in other ways; the various methods of grouping mantles offered alternatives for different classes of work. This lighting unit consumed only 16 B.Th.U. per candle-hour (lower hemispherical) as compared with 25 B.Th.U. consumed by the ordinary inverted burner.

In common with other branches of the lighting industry the gas industry had applied itself to propaganda work with a view to creating greater public interest in illumination, especially in the industrial field. Although much progress had been made, instances of bad lighting were still to be found. Hence the work of popular education in the art of good lighting must continue. In this connection the gas industry gladly acknowledged the great educational work done by and through the Illuminating Engineering Society.

DEVELOPMENTS IN GAS FITTINGS.

MR. PHILIP SUGG presented a short review of progress in gas fittings and accessories. One of the most important steps was the progress in distant control. Devices utilising clockwork, pressure-waves and the "mercurial seal" had been in use for some time. The chief drawback to the latter system was the necessity for a separate supply to the bye-passes. He illustrated and described a new apparatus which eliminated this drawback, based on the use of two valves, one controlling the main supply, the other the bye-passes. The method had proved useful for a variety of purposes, *e.g.*, for controlling alternate lamps on railway platforms, and for distant control in large halls, stores and places of worship.

Mr. Sugg then proceeded to refer to semi-indirect gas lighting. He remarked that one difficulty in this form of apparatus was the tendency to blackening of ceilings. The "Bon Marche" pendant devised to overcome this difficulty carried the usual superheater fitted with four, six or eight mantles, surrounding which was an enamelled steel reflector of large diameter. Combustion products were not allowed to impinge on this reflecting surface, but were carried up through its centre by means of a short circular chimney, which served as a protector to the ceiling immediately above the light. Thus the products were expelled over a wide area through the space existing between the two spinnings. Any soot caused by imperfect regulation of burners was deposited on the under side of the upper spinning, without detriment to the cleanliness of the reflector.

NEW FORMS OF ELECTRIC GASFILLED LAMPS.

THE next item on the programme was a demonstration by Mr. L. E. BUCKELL of gasfilled lamps sprayed by a new process on the bulbs whilst the lamp is rotated. The material consisted in finely ground china clay in suspension, the white coating being subsequently treated with a special fixative solution, and the whole made permanent by the application of heat.

The result of the process is to give a bulb which appears evenly bright all over, the actual filament being invisible so that glare was eliminated. A feature of the new process was the attainment of this result with a minimum absorption of light, not exceeding 6 per cent. Another feature, illustrated by polar curves, was the very uniform distribution of light in different directions, the variation being only 12 per cent. as compared with 40 per cent. in the bare lamp. The coating was quite permanent and could not be easily removed, and the process only added about 10 per cent. to the cost of the lamp. Another advantage over an opal bulb was that lamps could be tested after manufacture before the white coating was applied. The coating had also no appreciable effect on the life of the lamp. A further development, illustrated by Mr. Buckell, was the production of coatings in various colours, a device which was likely to prove very useful in the developing field of colour-effects and which placed a new weapon in the hands of the illuminating engineer.

Mr. Buckell next showed a series of gasfilled lamps in cobalt-copper glass bulbs, exercising colour-correction in a very simple manner. By careful selection lamps suitable for accurate colour-matching could be supplied, but their chief use was in cases where moderate resemblance to daylight attained by simple means was desired. Naturally such units should be applied with discretion. Mr. Buckell suggested, for instance, that whilst they would be very suitable in a florist's shop they would not be suitable for exhibiting meat. Mr. Buckell mentioned that the absorption of light by these bulbs was about 30-40 per cent. and naturally allowance for this must be made. The lamps, it was stated, were already being largely used in connection with high class window lighting and they had many special uses. For instance, in machine shops it had been found that lines and

gauge marks could be read more easily by colour-corrected light. They had also proved suitable for enabling wheat to be sorted by colour and again in the sorting of dross from coal in collieries.

In conclusion, Mr. Buckell showed some of the latest types of projector lamps. Tubular types with grid or bunch filaments, concentrated within a small area, had proved useful for optical work as the filament could be brought near the condenser. The lamps were made up for use direct on ordinary supply voltages up to 200-260 v., thus eliminating the inconvenience of a resistance. An item of interest was the 3,000 watt projector lamp as used with the Schwabe Hassite Theatre Lighting Apparatus at St. Martin's Theatre, His Majesty's, Queen's Theatre, etc. Mr. Buckell also showed a still larger lamp, the 4,000 w. lighthouse lamp (80 v. 50 a.) similar to the one in use for several years at the S. Foreland Lighthouse under the control of Mr. D. W. Hood, Engineer to Trinity House.

THE IRWIN COLOUR FILTER SYSTEM OF ILLUMINATION.

MISS BEATRICE IRWIN recalled that this method of lighting was first shown at the Annual Congress of the American Illuminating Engineering Society on the occasion of a "Colour Symposium." The aim of the system, as explained in the author's book on *The New Science of Colour* was to present colour-combinations of determined values in prescribed proportions, thereby providing decorative variety and specialised qualities of illumination to meet the requirements of the eye. Much attention was now being given to the need for scientific application of colour. It was now recognised that the pleasure and benefit derived from light in nature are owing to three factors, namely diffusion, concentration, filtration, and fluctuation, and upon these three principles the system of filter illumination was based. The vibratory values of light and shade were presented in balanced combinations, and in flowing surfaces of colour free from fatiguing effect, and productive of a new quality of light, approximating to the variety and atmospheric depth of light in nature.

The principles of which Colour Filter Illumination operated could be applied in a variety of ways and adjusted to all kinds of buildings, but in order to illustrate the methods a series of units had been constructed and named. These included octagonal and hexagonal shades, and others in the form of columns of various sizes. ("Mandarin," "Monoplane," "Zephyr," "Vesta," "Orientale," "The Tower," etc.) In each case the light was diffused by special parchment paper, tinted in pleasing combinations of colour. Sources of light could be applied in overhead units, pedestal types, and portable forms suitable for reading and various kinds of work. The hand-painted parchment paper, serving as the filter, had been selected after exhaustive experiments as the one capable of producing the best colour-values combined with efficiency of illumination.

A wide range of colours was utilised—blues, greens and yellows of classified values as the best hues for reading and working illumination, whereas rose, orange and deeper blues were employed for decorative effects. In every case these hues were combined with two or more colours to produce a total light-value of predetermined quality, and of dynamic visual appeal.

In conclusion, Miss Irwin remarked that by a discriminating application of colour to illumination one could enhance the values of textiles, paintings and woodwork, sculpture and stone, and create a warmth and transparency of light, tempered by delicate shadow that brought added health and beauty into our surroundings.

HOLOPHANE COLOUR UNITS.

CAPT. E. STROUD then exhibited some Holophane units containing lamps of small consumption stained with various combinations of colours. These hues were transferred to the surface of the glassware with pleasing effect. The

lighting units so treated were not regarded as useful for providing more than a very subdued illumination and were employed chiefly for decorative effect. They had been found very serviceable in kinema theatres, and had also applications in halls and vestibules of places of entertainment, etc., where striking decorative effects were desired.

THE POINTOLITE LAMPS FOR ALTERNATING CURRENT.

MR. E. GREETHAM exhibited the new 150 c.p. A.C. Pointolite Lamp, which has been designed to meet demands occasioned by the prevalence of alternating current circuits.

Mr. Greetham pointed out that the lamp itself was simliar in appearance to the 3-electrode Pointolite, but two globules were employed instead of a globule and a plate, both globules being of the same size. The method of operation was also similar to that adopted for the 3-electrode d.c. lamp but was simplified by reason of the fact that no switch-gear was needed for changing the polarity of the electrodes.

The lamp was used in conjunction with suitable resistance and switchgear, the latter consisting of two single-pole single-way tumbler switches. One switch served to connect one end of the ioniser to one of the globule electrodes which was, in its turn, connected coupled to one pole of the supply, while the other switch served to connect the other end of the ioniser through a resistance to the other pole of the supply. These switches were so interconnected that they could only be employed in their correct order.

Mr. Greetham then demonstrating the sequence of operations in starting the lamp and mentioned that it had been on the market for about a year and had proved generally satisfactory on all normal voltages and frequencies.

THE "CRAFTSMAN" MOTOR HEADLIGHT.

Mr. A. B. WALLIS gave a demonstration of this new form of motor-car headlight, which is designed to project a flat-topped beam of great power and practically even intensity across the roadway.

He explained that the system consists essentially of an accurately shaped reflector of special shape, and a lamp with a line filament situated horizontally along the axis of the reflector. The cap has a fitting piece soldered to it in which the bulb is accurately focused, and the lampholder is rigidly mounted in the reflector in a fixed position so that when a bulb is inserted the lamp-holder engages the fitting piece and holds the lamp bulb firmly in the focused position—an essential element in securing the desired distribution of light.

Mr. Wallis then explained how the special distribution of light was secured by the shape of the reflector. The lower half of the reflector was a semi-paraboloid, with the extremity of the filament most remote from the apex at the focus. This arrangement gave a flat-topped half cone of illumination. The upper half of the reflector was composed of two partial paraboloids having their foci at the other extremity of the filament and having their axes slightly "angled" outwards in the horizontal plane. The light beam projected by the upper half of the reflector is made up of two inverted and angularly disposed quarter cones of illumination. The effect of these various constituents of the reflector was shown by obscuring the various portions in turn. Direct light from the filament illuminates a wide area all round in front of the lamp so that signposts can be read and the sides of the road hedges, overhanging trees, gateways, etc., can be clearly seen. There is thus a powerful driving illumination ahead of the car, confined below a horizontal plane the requisite distance above the roadway, and supplemented by diffused illumination giving ample illumination of objects at the side of the road.

The proper distribution of light depends entirely on the position of the filament

with regard to the reflecting surfaces, and the special arrangement providing for this was described in detail by Mr. Wallis. The length of the filament must also approximate closely to the distance between the two foci, as explained above.

In conclusion it was pointed out that the "Craftsman" system, besides having a high efficiency, could be fitted in a lamp body of the usual size and shape without in any way detracting from the appearance of the car to which it is fitted.

ILLUMINATED SIGNS.

ONE other exhibit remains to be mentioned, the display by Mr. E. T. RUTHVEN MURRAY of some of the latest forms of "Internalite" signs, examples of which have been shown before the Society on several previous occasions. In the new models the chief features were the arrangements whereby a portion of the light could be allowed to strike backwards on the contents of a shop-window or on the counter, some pleasing new combinations of colour equipped with interrupter to secure a succession of changes, and a double glass sign which showed brilliantly illuminated lettering or coloured devices simultaneously at both back and front. In all cases the essential principle of obtaining illumination of the lettering or design by light from concealed tubular sources, underground total internal reflection within the glass panel, was adhered to.

THE APPLICATION OF SCIENTIFIC ILLUMINATION IN PRACTICE.

(Proceedings at the meeting of the Society held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 8 p.m., on Tuesday, December 11th, 1923.)

A MEETING of the Society was held at the House of the Royal Society of Arts, 8, John Street, Adelphi, W.C., at 8 p.m. on Tuesday, December 11th, Mr. L. GASTER, presiding.

The Minutes of the last meeting having been taken as read, the HON. SECRETARY read out the names of the following applicants for membership, announced at the previous meeting, who were now formally declared members of the Society:—

Mr. PETER BAX	..	Consulting Engineer, Manchester.
Mr. JOSEPH DOAK	..	Burgh Lighting Inspector, Greenock.
Mr. W. MAURICE	..	Mining Engineer, Sheffield.
Mr. P. D. MORRIS	..	Electrical Engineer, Southgate.
Mr. J. M. WALDRAM	..	General Electric Co., Ltd., Illuminating Engineering Department, Magnet House, Kingsway.

The HON SECRETARY then called upon Mr. GEO. HERBERT to open the discussion on **"Some Applications of Illuminating Engineering in Practice."** Mr. R. A. IVES subsequently gave a series of demonstrations illustrating various effects of light on the eye.

In the subsequent discussion Mr. J. S. DOW, Mr. W. R. RAWLINGS, Mr. HAYDN T. HARRISON, Capt. E. STROUD, Mr. W. E. BUSH, Mr. G. CAMPBELL, Mr. J. G. CLARK, Mr. J. F. CAINE, and the CHAIRMAN took part.

Mr. HERBERT having briefly replied to the discussion, the CHAIRMAN announced that the next meeting would be held on **January 22nd,** when a discussion on **"Co-ordination of Research on Illuminating Engineering and some Practical Applications"** would be opened by Mr. J. S. DOW.

THE APPLICATION OF SCIENTIFIC ILLUMINATION IN PRACTICE.

By GEO. HERBERT and R. A. IVES (*Sales and Engineering Depts. of The Benjamin Electric, Limited*).

(Introduction to a Discussion before the Illuminating Engineering Society, held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 8 p.m., on Tuesday, December 11th, 1923.)

Introduction.

In initiating a discussion on this very wide subject the best we can hope to do is to furnish a starting point, and this can be accomplished by some personal experiences which others will doubtless be able to supplement.

Illumination theory and practice do not necessarily always coincide. To the illuminating engineer the application of scientific illumination in practice, owing to the progress during the last few years, to-day has very few difficulties. The advance in the manufacture of the light source and the improved scientific equipment available for same enables the engineer to overcome many problems which in the early years were impossible.

The attention that has been paid by lighting engineers to the question of "glare," and the continual insistence of the need for screening light in the direct range of vision is gradually bringing about a different outlook amongst the public, who now more or less readily understand the principle of "light on the object, and not in the eye."

Another matter of interest was, and still is, the measurement of light and illumination, and now the term "foot-candle" is familiar, and the lumen better understood to almost all those who are concerned with lighting, while even non-technical people, even though they may not understand the terms, readily grasp the fact that the fundamental idea is the actual illumination on the place of work rather than the apparent brightness of the sources of light.

Illumination photometers to-day have many forms, and are, on the whole, compact and useful instruments which are not only of value, but essential to lighting experts in enabling them to ascertain the illumination actually existing so as to form an idea of what is necessary, and then to show by actual measurement where a consumer's installation has been improved.

While there are available a few simple instruments easy to understand and use, we may perhaps, by some photo-electrical method ultimately obtain an instrument which will register by the motion of a pointer when presented towards the light.

We are particularly in need of some simple test for glare, a complicated problem which can probably be solved with the help of the physiologist.

The Importance of Data.

Under this heading those particularly concerned must be congratulated on the efforts that have been made and the data which has been published. Statistics of many kinds are available, while particularly useful are those showing the relation between lighting and accidents. Authentic information of this kind provides valuable "ammunition" for those concerned commercially with lighting development. Equally valuable is the presentation of records showing how better lighting conditions have benefited manufacturers by leading to a reduction of spoilage, which, of course, means an improvement in output. While recording appreciation of the work done in this direction, one recognises that there remains a great deal to do. Collective effort with reliable references of a wide but definite character are still required. We commend attention to this phase of activity to the many new adherents to the science of illuminating engineering, as their combined efforts could render a great service both to the public and to the lighting industry.

The Fundamentals of Good Lighting.

One of the first problems in approaching the consumer is to consider his natural query:

"Well, what is good lighting?"
One must be able to convey the answer without technicalities, and whilst we all know that there are various special requirements to be met, differing greatly according to the nature of the work, the principles outlined in the first Home Office Committee's report seem to cover the fundamentals:—

1. Sufficiency of illumination over the working area.
2. Reasonable uniform illumination over the working area.
3. Avoidance of glare. Either from bright unscreened sources exposed within the direct range of vision, or in the form of direct reflected light from polished material.
4. Avoidance of inconvenient shadows.

To these should be added those conditions insisted upon in the latter reports, viz.:—

(*a*) Constancy of light source (absence of flicker).

(*b*) Avoidance of excessive contrasts by moderate general illumination.

One of the most difficult points to determine scientifically is the amount of illumination necessary for various processes. There are several factors contributing to this difficulty, and perhaps the chief one is the lack of knowledge on the consumer's part as to what good lighting really means. Instead of it being made an item of primary consideration, it is more often than not pushed into the background and left to take care of itself. This apparent apathy can only result from insufficient knowledge of the subject. To put it mildly, the average consumer is reluctant to appreciate how necessary, and how exceedingly economical it is to install good lighting, or else too busy or too uninterested to learn.

On the other hand, it should be recorded that in most cases where correct lighting has once been installed, the appreciation of the user has been such that it has been a comparatively simple matter to increase intensities far above those originally arranged and considerably in excess of values customary a few years ago.

Thus the need of convincing and undebatable evidence on the necessity for good lighting to the consumer of to-day will be at once apparent.

In many modern factories a general illumination of ten foot-candles and more is most desirable, and we have every reason to know that this is more than justified by the easier conditions of work. Certainly, wherever higher values are adopted, people never wish to return to the old conditions.

While, therefore, the engineer can *advise* the adoption of certain illumination standards based on his own experience and knowledge, the consumer will be hard to convince until he has at any rate some basic idea of what improved lighting will mean to him, his employees and his pocket.

This problem, however, can be solved if approached correctly by ensuring ample provision over the old practices.

It is very satisfactory, as we are informed, that the Home Office Factory Department is paving the way for such standards by arranging conferences with the Chief Joint Industrial Council on the industries concerned.

Obviously the actual user of light should have a say in such matters, and incidentally such consultation should have a most useful educational effect, but the fullest investigation and co-ordinated effort on the part of those engaged in the lighting industry is essential.

From the commercial and industrial standpoint it is most desirable to have fixed not only the amount of illumination for different purposes but the main principles of lighting defined by a recognised authority, representative of the producers, the distributors, and the consumers. These latter, however, must first be educated by means of demonstration and experiment on the part of the former.

It is not proposed to enter into the technical rules of spacing or general tables of utilisation efficiencies, etc., but it is most necessary at this discussion to emphasise the importance of proper designs, applications, and tests. Furthermore, any illuminating engineer knows that problems cannot be solved simply on the basis of hard and fast rules, but that equipment and installation rules have to be modified according to the

nature of factories, and that data is necessarily based on the type of reflectors nsed.

In this connection the fundamental principles must be applied as the basis, while common sense in inherent difficulties respecting specific application must prevail.

In passing, we should like to make reference to one pressing need, viz., uniformity of practice by lampmakers in regard to sizes and dimensions of lamps. All predictions of illumination are based on the polar curve of various lighting units, and these in turn depend on the correct position of the filament within the reflector. Variation in dimensions of lamps of the same wattage, especially in the distance of the centre of filament from the cap, not only distort the polar curve and render accuracy of prediction of illumination uncertain but may defeat the object of the designer of the reflectors and the intention of the lamp manufacturers in supplying the public with a useful commodity. Again, as the source of light may change by development, so must the appliance be made to meet such change. Therefore is the need of co-operation right through the industry once more made apparent.

To-day the position is better than ever before, and there is an atmosphere of development being created to meet the general requirements of industry, which in turn is now recognising the advantages to be gained.

The consumer, therefore, being our ultimate goal, let us briefly consider the advantages of better illumination from his point of view and the best method of distributing the service which will enable him to enjoy these advantages.

The Accident Hazard.

The statistics referred to earlier in the paper on the subject of accidents are no doubt sufficiently well known at any rate, to this audience without further reiteration. Compulsory standards of illumination are imperative if human material is to be conserved.

Improved Output and Reduction in Spoiled Material.

If it can be proved to the consumer that poor lighting is one of the most prolific causes of damaged material and, further, that under correct illumination his output will automatically increase from anything up to 12 per cent., he should be more than half convinced. Touch the purse-strings of production and you touch production itself.

Defective Eyesight.

For thousands of years the human eye has been developing, but only during recent time has there been, for the great mass of people, any need for long-continued application of the eye to the discrimination of fine detail. In fact, the average human eye is being called upon to adapt itself to conditions entirely different from those under which it has worked throughout all previous times.

In other words, the case is not one of evolution, but of revolution.

Unfortunately there are no definite data with regard to the eyesight of industrial workers generally; on the other hand abundant data are available with regard to defective eye-sight in schools.

It has been found that the number of short-sighted pupils increases from class to class. Also the average degree of short-sightedness similarly increases, likewise the number of short-sighted pupils increase proportionately with school educational demands. In one report, where 23,356 pupils' eyes were examined, it was found that 26 per cent. needed glasses.

Whilst poor lighting is certainly not to be charged with all the causes of eye trouble, it is unquestionably an important contributing factor, while good lighting has beneficial effects on the health and cheerfulness of the human being.

Practice.

You know, and we know, that good illumination pays, not only its own cost but also extra dividends as a compensation for skill and intelligence in factory management. It has been proved many times by actual comparative tests, and can and must be proved again and again until it is an accepted fact on the part of the public.

The illuminating engineer's primary object in life is to interest and convince as large a section of the public as possible in the service and undoubted benefits he

has to offer. His problem lies in applying his achievements for the use of society as a whole. Otherwise his activities and his knowledge are of little practical use, inasmuch that they are not universally adopted.

In other words, the seal of public approval is necessary for the justification of his industry and the capitalising of his knowledge.

Such approval is hard to arouse unless the method of distribution is efficient.

How best to accomplish this is the object of this discussion, but we would suggest that efforts along this line alone are insufficient. They must be supplemented by the use of the whole lighting industry as a medium for the dissemination to the public of the knowledge possessed by the illuminating engineer.

As mentioned previously, " technicalities " must be avoided, as they cannot be understood by the great majority of the public.

The average consumer has not the slightest interest in watts, amperes and volts, nor yet in lumen and foot-candle values, except as a basis for comparison. What he is interested in is the effect—the benefits he will enjoy if he spends his money on improved lighting.

If the engineer has highly technical data to disseminate, let it go through logical channels—through the electrical industry, so that it reaches the consumer shorn of unnecessary technicalities by the ultimate distributors, and presented in an attractive form which the public will easily understand and readily appreciate.

Education of the public in lighting matters is essential, but only to the extent of proving to them the many advantages and enabling them to visualise what they are actually purchasing in illumination.

Whether this can (as it should) be done through the logical trade channels is a matter for debate. Our feeling is that the trade as represented by the wholesale distributor, the electrical dealer or contractor, and the central station engineer should know enough about the technical side of the whole subject to enable them to interpret it into convincing language for the consumer, and imbue it with commercial and economic salesmanship.

They should be in a position to recognise instantly the many causes of bad lighting, to prescribe the correct remedy, and by demonstration of correct fundamental principles to propound the illuminating engineer's message.

Imagine the possibilities before the electrical contractor, for instance, when he sets out to sell *illumination* instead of so many feet of cable, conduit and all the accessories of wiring, and when instead of cut-throat competition on standard lines, he engages in healthy competition on the basis of quality of illumination provided and service rendered.

Obviously, the supply authorities also have a definite place in the scheme of things, as, providing the necessary energy to operate the equipment, the greater the public interest, the greater the demand for their service and product.

In fact, every section of the industry is affected and the co-ordination of their efforts and resources is the only feasible and logical arrangement to ensure success.

It would be interesting to discuss the difficulties and exceptions which arise in practice. The difficulties, as appreciated by those who have tried, can be easily overcome, providing one has an optimistic disciple. On the other hand, the case of the pessimist is more difficult, as is usual with this type of individual. But the fact remains that hard work and personal conviction supported by actual concrete evidence will in the end bear fruit.

We have all met the man that continually installs and frequently uses a bare lamp, from which he gets a brilliant light, but nevertheless forgets that the illumination is in the wrong place.

Also the individual who tells you that photometric and polar curves are all wrong, and that they are published to deceive the public.

The most hopeless case is often the man who should know better, who tells you that reflector design means nothing and he cannot see any difference between using a 25-year-old light with shade and a modern appliance designed for gas-filled lamps.

To appreciate the last instance, we have only to consider the large number of factories, public buildings, etc., which have been designed and erected during

the last few years, and which are still being designed and erected without any proper provision for artificial lighting—another, and yet more insistent example of lack of knowledge of an important subject, only to be put right by the continued and co-operated efforts of the lighting engineers.

These questions and many others occur frequently, and require patience to put in order.

Next we come to the intelligent inquirer, who has possibly worked for years in the old-fashioned methods—the individual who, for lack of education, uses a candle instead of an oil lamp, or an open flame gas burner instead of a high pressure gas, or again, the vacuum lamp instead of the gasfilled lamp. This is the man we all like to meet, for when the subject is explained in simple terms it is readily appreciated and the advice given is acted upon.

One of the greatest difficulties is to convince the employer and employed that it is not the glaring lighted factory that produces the most work, and here a test installation usually produces a convincing effect. The use of a light meter has been known to entirely alter their views.

A general case is that of a spinning mill, where very often the building has been splendidly designed, the machinery fitted in first-class style, walls and ceilings perfectly white, and everything spotlessly clean, and yet bare lamps are installed on ordinary drop pendants. Naturally a low intensity value of illumination on the work is the result. Yet no complaints are made by employees, because they have not enjoyed a better standard, and no complaints from the directors, because they are unaware to what extent they are suffering financially, or how their employees' health is being undermined.

In practice it is desirable to find out what is in the consumer's mind, and with a full understanding of his mental and actual difficulties one can usually show how he can by following fundamental principles improve his installation to his entire satisfaction.

Although so much has been done to add to our knowledge of principles of lighting, we are all, even the best-informed of us, still engaged in a practical science of immense possibilities yet to be applied.

The lighting engineer and in fact everyone engaged in this section of the industry has a wonderful service to offer. How many other propositions are there which can offer such an attractive array of benefits to the recipients? Is there any other which has such a wide and lucrative field for its efforts? Is there any other which by propaganda and energy can benefit such a large section of the whole community?

Good lighting in industry means 12 per cent. more production, 25 per cent. less spoilage, and 25 per cent. fewer accidents—the three most important essentials of successful industrial operations—Production, Speed and Safety.

Good lighting costs less than 2 per cent. of the wages bill to install, and less than 1 per cent. of the wages bill to run and maintain. Nothing is so well appreciated by the user as good lighting. It brings a contented mind, and provides a continual feast for the eyes, and its attainment is dependent only upon the selection of proper lamps to supply the necessary primary lights and correctly designed reflectors to direct and distribute this light effectively.

The need of better lighting is so universal that it presents an immense field for work. Examples of really bad lighting are so numerous that the movement to promote better lighting cannot have too many friends and adherents. In performing this public service the resultant benefits to the entire industry can be hardly realised or appreciated. If only the *minimum* standard of illumination as recommended by competent authorities was adopted throughout the country immediately, there would not be sufficient material in the country to meet, even nearly, the demands. It would automatically involve the employment of many thousands at present unemployed, and constitute a practical step towards the solution of our present economic and social problems.

Right down from the large manufacturer and producer of generating plant to the smallest electrical contractor, embracing the many allied industries between, would the wave of prosperity be felt.

All would benefit to a much greater extent than can be possibly realised.

The market is here waiting to be developed, the brains and the services are available to meet the demands, all that is necessary to complete the chain is the link of individual effort and co-operative attack in educating the consumer in the benefits of one of the greatest of civilisation's gifts—LIGHT.

In submitting these few remarks, our object is to learn something more about this interesting and vital subject. The lighting industry's problem is to awaken the mind of the lay public to the point of active necessary interest.

All present will surely have some personal experiences which will be helpful to others, and some suggestions as to the best way of attacking this problem. It can be solved, and we hope that this discussion will do a lot towards it. Before the discussion is opened, Mr. Ives will show a few lantern slides of actual installations which we hope will be indicative of the ultimate appearance by night of all our industrial and commercial concerns under the beneficial treatment we have endeavoured to urge.

(After Mr. G. Herbert had read the paper a series of demonstrations and lantern slides were shown by Mr. R. A. IVES. Some of these illustrated various familiar optical illusions, the speaker pointing out how the impression received by the eye played a great part in the judgment of lighting installations. Views of a number of typical installations and corresponding data relating to positions of lamps were also shown, and several pleasing experiments were made to demonstrate fluorescence effects with ultra-violet light.)

DISCUSSION.

Mr. J. S. Dow, in opening the discussion, complimented the authors on their paper and referred to Mr. Herbert's early association with the Society. In the introductory part of their paper the authors had laid stress on the importance of data, illustrating the relation between accidents and inadequate lighting, and showing how good illumination contributed to productive efficiency. How could the Society best help in this matter? They could collect authoritative information on such points, as they were trying to do with the aid of the London "Safety First" Council, the B.I.S.F.A. and similar bodies. The task of manufacturers would be rendered much easier if they had authoritative data of this kind upon which to fall back. A consumer invited to spend money in increasing very greatly his standard of illumination naturally required some proof of the ensuing benefits. He (Mr. Dow) was all in favour of better illumination, but one must view the matter from the consumer's standpoint.

Dealing with propaganda Mr. Dow said that there were many methods of appealing to the public at large that could best be pursued by those engaged in the lighting industry, and he felt sure that all would agree that leading makers of lamps and lighting appliances were doing valuable educational work. But there were some forms of propaganda—for instance, in approaching public authorities, Government Departments, etc.—which admittedly were best done by a body representing all aspects of the subject, expert and consumer alike. In many cases, too, a problem could not be dealt with by one body—one must invite the help of other associations, as had been done in connection with the lighting of schools, streets and libraries. The appointment of the Home Office Committee on Factory Lighting had been a great step forward. In determining conditions of lighting for various industries the Home Office Factory Department was seeking the aid of leading joint industrial councils. Only by such means could a solution acceptable to all parties be found. In a recent discussion on the lighting of printing works Mr. Campbell had drawn attention to the great variation in opinions in the industry. It was hoped, as a result of research now being initiated, to arrive at conclusions which would meet the require-

ments of this industry, and could be quoted in support of their views by those concerned with putting up installations.

Another important aspect of propaganda was the correcting of misstatements on lighting. He and Mr. Gaster and other members of the Society had recently been able, at a meeting of another society, to point out the unsubstantial basis of various alarmist statements made by a lecturer, the dissemination of which would tend to check progress in lighting by all illuminants. It was of great importance to the lighting industry that such correction should be applied by those who had no axe to grind. Generally speaking one's aim should be to enlist the advocacy of medical men, architects and other outside experts, whose views carried weight with the public. Some of the papers read at the National Gas Exhibition furnished a good instance of such propaganda.

Yet another valuable channel for propaganda was furnished by the Press, which had shown itself exceedingly sympathetic to the Society's work. Efforts were also being made to promote the study of illuminating engineering at colleges, and the publication of a standard textbook. He could quote many other instances of valuable educational work which the Society had done, and he took the opportunity of paying a tribute to the remarkable personal efforts of Mr. Gaster, of which he had special knowledge but which, probably, only those intimately associated with the work were fully familiar. The time had come, however, when the work of a few enthusiasts should be supplemented by proper support in order that propaganda might be conducted on a large scale, and they looked to the lighting industry to provide the necessary support for the illuminating engineering movement to develop to full fruition.

Mr. W. R. RAWLINGS, who followed, recalled that he had joined the Society in its very early stages and had attended most of its meetings. He paid a tribute to Mr. Gaster's power of imparting knowledge in a simple form, and referred to the importance of interesting the contractor in scientific methods of lighting.

Mr. HAYDN T. HARRISON complimented the authors of the paper, which was put together in an admirable way. Engineers and others associated with lighting came in contact with a considerable number of people; yet the number probably still formed only a small section of the general public. He thought that in approaching people one must make positive suggestions. It was instructive, for instance, to show the great contrast between really bright illumination and inadequate lighting; similarly in dealing with glare one should be able to show a method of lighting in which the freedom from dazzle was quite obvious. He fully agreed as to the importance of reliable data. There were certain items of information that were repeated in every book and catalogue, but there were other data, *e.g.*, relating to depreciation of candlepower or variations in efficiency of light-sources, which were not readily forthcoming and he hoped that the Society would see that this also received attention.

Capt. E. STROUD said that he was glad to see the importance attached in the paper to knowledge of scientific principles of lighting. The lighting industry was in a state of constant development, and anyone approaching the public should have full knowledge of recent progress. In this respect meetings of the Society had been very helpful.

However, he quite agreed with the authors that, besides technical knowledge, one must have knowledge of human nature—adopting a sympathetic attitude to the views of the consumer, listening to his arguments, and not adopting a dictatorial attitude. He must also know when to depart from stereotyped methods, without transgressing fundamental principles of good lighting.

The experience of the last few years revealed a general tendency towards the adoption of overhead lighting and the elimination of local lights. Values of illumination were becoming higher than in the past but he thought 10 foot-candles should answer almost every requirement.

He endorsed what had been said about co-operation between firms in the lighting industry. The firm with which he was associated was one of the earliest to

organise periodical conferences. In arranging lectures before various societies throughout the country, much of the information presented at meetings of the Society had proved useful. Equally important was the question of co-operation between lamp maker and manufacturer of lighting fittings, in order to ensure standard dimensions of lamp bulbs convenient to both parties. It must be acknowledged that the great change in the attitude of the public towards illumination was due largely to the efforts of those engaged in the commercial side. But it should be recognised that there was much influential work in high quarters that could only be done efficiently by a body representing all illuminants and all aspects of illumination.

Mr. W. E. BUSH remarked that in illumination, as in other fields of knowledge, practice and theory did not always coincide. In practice the consumer might find advantages in standards of illumination higher than those justified by scientific research. There was no doubt the public needed more light, but they could not be induced to accept it until the drawback of glare was eliminated. He endorsed the values of illumination mentioned by the authors in their paper, about ten foot-candles, but he thought that in time to come much higher values would become general. The present tendency in the design of equipment was to enable such illuminations to be provided without glare. In regard to instruments for measuring illumination he thought that some of those available were a little too technical and complex. What was needed was a simple instrument that would readily indicate the difference between extremes, *e.g.*, between 1/10 and 10 foot-candles, in wide steps. Demonstration was the surest method of education, and efforts by the Society, manufacturers and others interested should be concentrated in that direction. In regard to the sizes of lamp bulbs he was authorised to state that these were now standardised by the electric lamp manufacturers.

Mr. G. CAMPBELL thanked Messrs. Herbert and Ives for their paper. Propaganda was excellent, but work was also necessary. Every branch of the industry should be doing definite practical work. People were best influenced by force of example. Demonstrations formed the best means of approaching the public. Captain Stroud had referred to the tendency to eliminate local lighting. The policy of overhead lighting had been approved for the last ten years. In regard to values of illumination he was surprised that ten foot-candles should be regarded by anyone as sufficient. Already accepted values were far higher than in 1908, when lighting engineers habitually spoke of 2 to 3 foot-candles, and it was to be hoped that in time to come artificial illumination would be as good as that obtainable on a bright day in May.

Mr. J. G. CLARK, after thanking the authors for their paper, remarked that it contained no reference to daylight illumination; after all we still had many more hours of daylight than artificial illumination. Some difference of opinion had been expressed with regard to the attitude of consumers. He himself, in a particular case, had pressed home propositions for improved lighting partly on the ground of economy and partly on the ground that more work could be done. The consumer responded that the workmen, being under trade union rules, would occupy certain time on a certain job in any case! This illustrated the difficulty in dealing with some consumers. He also recalled a case in which it was contended that the light must be movable so that the worker could adjust its position at will. Accordingly a lamp capable of movement was provided. After trial for a month or so it was observed that the workmen had found the best position for his light and never altered it afterwards, thus showing that the need was not for a movable light but for one in the correct position. Sometimes the supplier of illumination met with a demand for something that the supplier believed was not the best, but nevertheless he might find it wiser to let the consumer have his own way.

Better illumination created its own demand. In large factories, where there was reluctance to improve the lighting, owners had been induced to have a

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limited number of new units placed in the works on approval. What happened at once was that the workman who had the benefit of working under the better light became the envy of all the others. This feeling spread throughout the factory and it was not long before the whole job could be carried out completely. He (Mr. Clark) joined with the authors in their appreciation of the work of the Home Office. He agreed that one should not attempt to work too closely to hard and fast rules; every case had to be dealt with on its merits and it was not often possible to lay down a uniform scheme which would be applicable throughout the entire factory. It was usually wise to experiment with a few units first. One point of consequence was the reclaiming of dark corners. It seemed strange that there should be corners of factories which the managers said could not be used because they were too dark. In many cases better distribution of light had eliminated these dark spots.

Several speakers had referred to intensity of light. At one time one or two foot-candles was usually prescribed, but this was only a stage in the development of lighting and he hoped that such low values would be forgotten as soon as possible. After all light was cheap and if more of it was needed it was not really so much a matter of expense as of brains in applying it properly.

Mr. J. F. CAINE said that the best manner of getting consumers to appreciate the benefits of good illumination needed further discussion; it seemed to him that the mass of consumers could be reached most readily by suppliers of lighting appliances and electrical contractors, provided they had a good understanding of scientific illumination.

Methods must be progressive. The best intensity of illumination to-day would probably be considered insufficient in the future, and meantime there was much divergence in opinion. If one took four or five catalogues one found that

the values of illumination recommended for various purposes did not agree, and the Society could do useful work in collecting information and establishing the correct illumination for various industries.

Mr. Herbert had emphasised the point that what one really sold was illumination. But it must not be overlooked that illumination could only be provided by the aid of cables and wire. One had in fact not only to sell good illumination but also good *installation*. He could confirm what Mr. Bush had said in regard to lamps; the essential dimensions were now standardised and if there was still any room for doubt in regard to lamp bulbs this would be removed very shortly.

The CHAIRMAN (Mr. L. Gaster), in winding up the discussion recalled that it was about 16 years since the nature of illuminating engineering was first explained. In determining conditions of illumination the practice had been for a series of measurements, illustrating actual prevailing conditions, to be made. Next a joint committee, comprising experts and users of light, was formed in order to crystallise the conclusions derived from such tests and discussions before the Society. This was the course followed, for instance, in regard to lighting in schools and libraries on which reports had been issued. But after this work had been done there was still the problem of getting publicity for the conclusions, and they looked to those in the lighting industry to help in making them known and carrying them into practice.

The reports issued by the Home Office Departmental Committee on Lighting in Factories and Workshops had been brought before meetings of the Society and discussed in all their bearings, and there was no doubt that the publicity thus gained for them had been very valuable. As he had explained on previous occasions one could not frame legal standards for working illumination without very careful inquiry. But the anticipated clause, requiring that good lighting in general terms should be provided, would give a great impetus to industrial lighting and would strengthen the hands of all those who were trying to induce consumers to adopt better methods.

He agreed with Mr. Dow that when one asked the consumer to adopt much higher illuminations than at present he would want to know the grounds on which the proposition was based. It had been suggested in the discussion that propaganda and work must go hand in hand. In the Committee on Illumination appointed by the Department for Scientific and Industrial Research they had a means of doing much valuable work on these outstanding problems, and he hoped that one of its first efforts would be in the direction of determining the conditions of illumination requisite in various industries.

Mr. GEO. HERBERT replied very briefly to some of the points in the discussion, remarking that the paper was primarily intended to provoke discussion and seemed to have answered this purpose, and after a vote of thanks had been passed to the lecturers it was announced that the next meeting would be held on January 22nd, when Mr. Dow would open a discussion on "Co-ordination of Research in Illuminating Engineering."

WANTED—A "BRIGHTNESS-PHOTOMETER."

IN his presidential address to the American Illuminating Engineering Society, which appears in the *Transactions* for October, 1923, Mr. Ward Harrison refers to the need for a simple instrument for measuring brightness—a need experienced in this country in connection with the study of glare. It is also of interest to note the draft of a chapter on lighting, prepared as a suggestion to writers of textbooks on High School Physics, and also as a guide to instructors on the subject. In this country the preparation of a special textbook on Illumination for the use of teachers and students at technical colleges is also being considered.

TOPICAL AND INDUSTRIAL SECTION.

[At the request of many of our readers we have extended the space devoted to this Section, and are open to receive for publication particulars of interesting installations, new developments in lamps, fixtures, and all kinds of apparatus connected with illumination.

The contents of these pages, in which is included information supplied by the makers, will, it is hoped, serve as a guide to recent commercial developments, and we welcome the receipt of all *bona-fide* information relating thereto.]

MODERN SHOW-WINDOW LIGHTING.

An illustration of efforts on the part of makers of lamps and lighting appliances to interest the public in illumination was afforded by the demonstration of show-window lighting arranged by the General Electric Co., Ltd., at Magnet House, Kingsway, on October 25th. The meeting was attended by a considerable number of representatives of members of the British Association of Display Men, and a model show-window was mounted on the stage of the conference hall, equipped with various methods of lighting.

After the proceedings had been opened by a short introductory address by Mr. J. Y. Fletcher, a Director of the Company, Mr. E. L. Randall read a paper in the course of which he pointed out that a well-lighted show-window was one of the most vital factors in business-getting machinery. Co-operation between the merchant and the artist had led to a great advance, and the credit for this was due largely to the activities of the Association. For nearly six months in the year windows are entirely dependent on artificial illumination for 30 per cent. at least of their effective day.

Mr. Randall emphasised the fundamental principle of avoiding glare from exposed sources and concentrated light from concealed sources on the goods. But he also pointed out that there were great possibilities in artistic treatment beyond the observance of this simple principle. Some of these effects were illustrated in the demonstration, various intensities of illumination, light distributed in diverse ways, and different combinations of coloured lights being shown. Mr. Randall contended that the profit per hour resulting from improved window lighting far exceeded the cost involved—in some instances it was 20 times as much. In order to illustrate this, he mentioned that according to his experience in various London shopping centres at least 250 persons per hour would stop to examine a window, the cost of illuminating which was 2½d. per hour—a very small outlay for the advertising value received. Colour-effects were specially valuable in attracting attention and the use of the "Gecoray" silvered glass mirror reflectors with special filters enabled endless combinations to be obtained. These combinations could be altered at intervals by an automatic flashing device. Great importance was attached to leaving windows illuminated after closing time, for which purpose some authorities were now granting a special reduced rate.

The ensuing discussion was opened by Mr. Leon Gaster, who congratulated the Company on this example of enterprise in bringing home the value of good window lighting, and advocating the principles which the Illuminating Engineering Society had been identified for the last 14 years. Various problems were raised from the standpoint of the window-dresser, and after an interval for tea, there were other demonstrations of lighting effects.

CIRCLE OF SCIENTIFIC, TECHNICAL AND TRADE JOURNALISTS.

On October 10th a visit was paid by members of the Circle and representatives of the technical Press to the new showrooms and laboratories of Holophane, Ltd. (Elverton Street, Westminster). The visitors having been welcomed by Mr. H. H. Thompson, the Managing Director, a short address was delivered by Capt. E. Stroud, who gave a summary of recent developments in illumination. It was explained how the great brilliancy of modern sources of light had rendered proper methods shading essential and how scientific design enabled the distribution of light to be controlled. The address was illustrated by lantern slides of typical modern lighting installations and a variety of lighting units, including the latest form of "artificial daylight" equipped with Chance's daylight glass, was exhibited.

Visitors were afforded an opportunity of inspecting the laboratories and demonstration rooms, after which Mr. Leon Gaster, Hon. Secretary of the Circle, in returning thanks for the visitors, remarked that the scientific application of light was a subject of great interest to the technical Press, and its importance was illustrated by the appointment, in 1913, of the Home Office Departmental Committee on Lighting in Factories and Workshops. He hoped that each scientific advance would be brought before the notice of the technical Press, which acted as an educational link between the expert and the general public.

VISIT TO THE BRITISH EMPIRE EXHIBITION.

At the invitation of the Council of the British Empire Exhibition, members of the Scientific and Technical Circle of the Institute of Journalists paid a visit to the British Empire Exhibition at Wembley, on October 22nd, in order to inspect progress. The Exhibition promises to be the biggest thing of the kind yet undertaken in this country. The grounds cover about 240 acres, and the construction of most of the buildings, including conference halls, industrial halls, the Palace of Engineering and the Palace of Industry, is proceeding rapidly.

The buildings are constructed almost entirely of reinforced concrete and present many interesting features. One very convenient arrangement is the carrying of rails along the centre of the large halls so that apparatus can be taken direct to the position they are to occupy. Great interest naturally attaches to the lighting of the Exhibition, and it is understood that concealed methods will be largely used and efforts made to provide pleasing conditions free from glare.

The visitors were subsequently entertained to tea and short addresses were delivered outlining the aims and objects of the Exhibition.

APPLICATIONS OF OSRAM DAYLIGHT GASFILLED LAMPS.

Information received from the General Electric Co., Ltd., shows that many applications for "artificial daylight" are being found. Daylight lamps have been installed at the premises of Messrs. Tillotson and Sons, printers, in Liverpool, whilst at the Arley Colliery, near Birmingham, a number of the lamps have been adopted to facilitate the sorting of dross from coal. Others who are making use of the lamps include medical men, dental surgeons, makers of spectacle lenses, etc.

ROYAL SANITARY INSTITUTE. THIRTY-FIFTH CONGRESS.

We are informed that the Most Hon. The Marquess of Salisbury, K.G., P.C., G.C.V.O., C.B., has consented to accept the office of President of the Thirty-fifth Congress of the Royal Sanitary Institute, which is to be held in Liverpool from July 14th to 19th, 1924.

Further particulars of the Congress may be obtained on application to Mr. E. White Wallis (Secretary), 90, Buckingham Palace Road, London, S.W.1.

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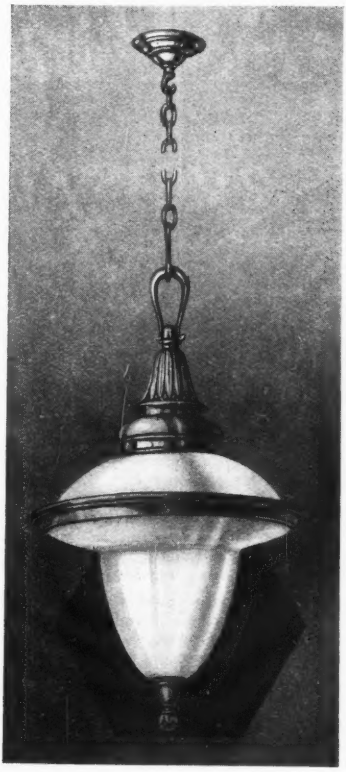

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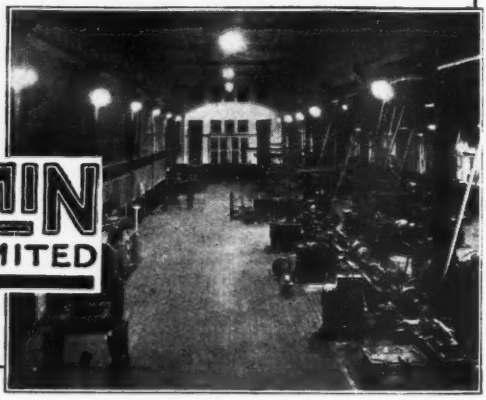

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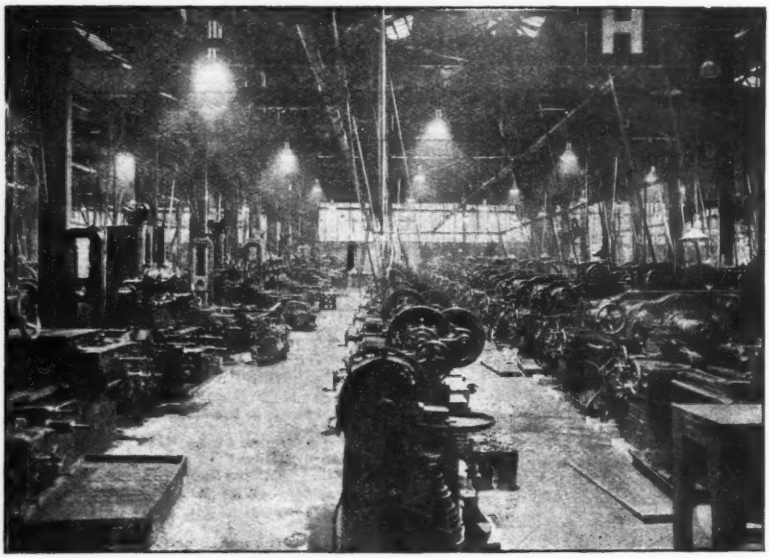

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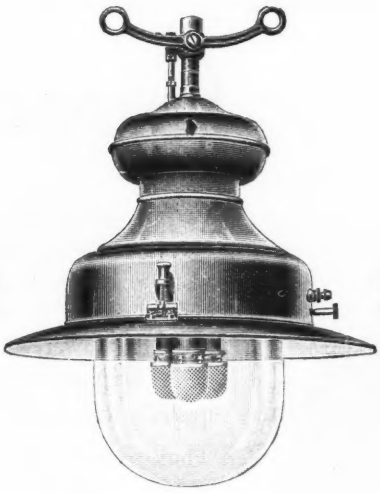

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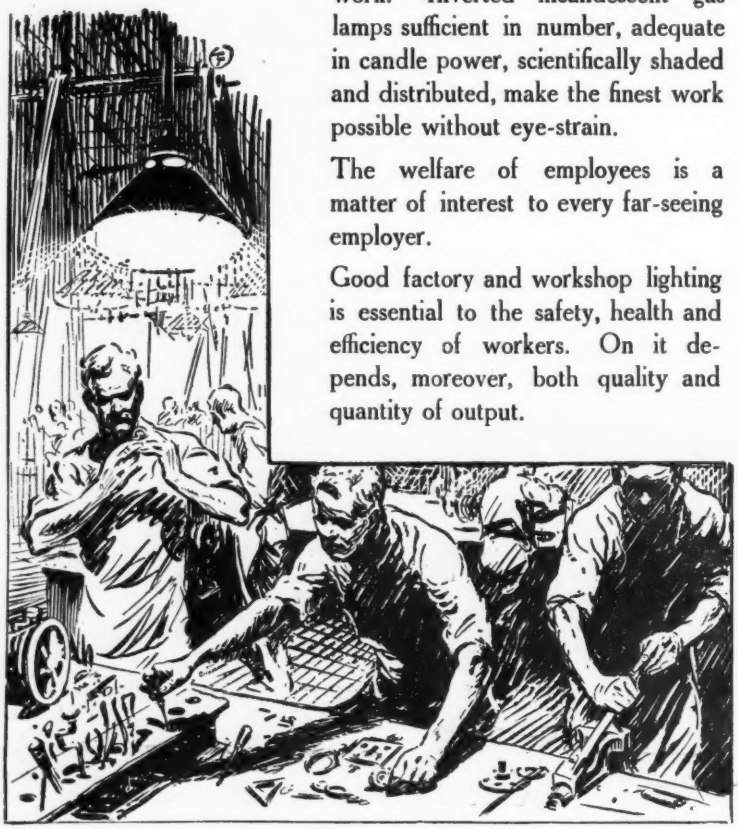

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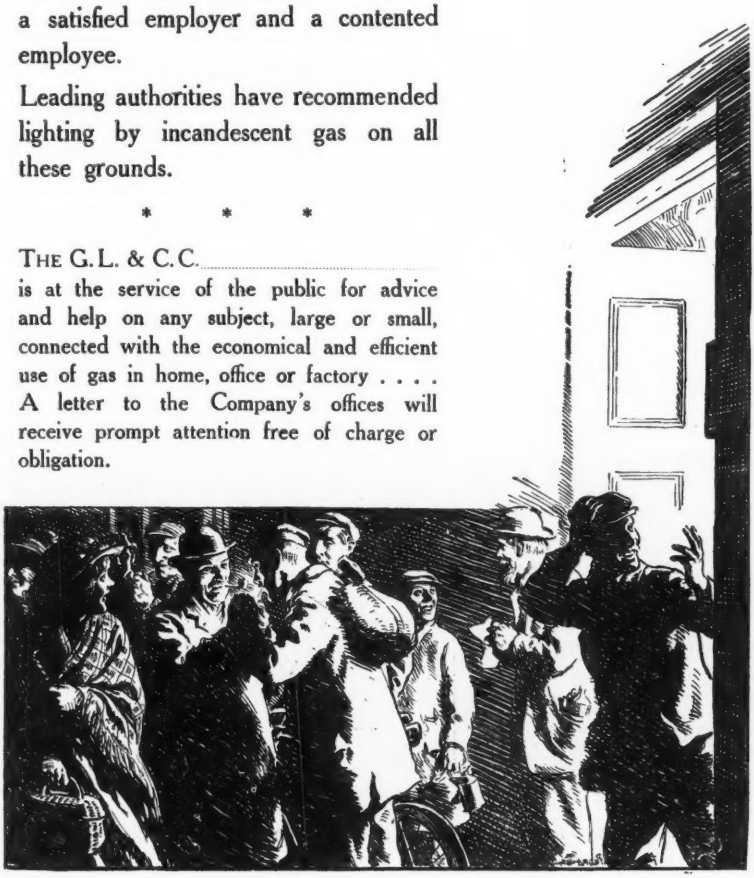

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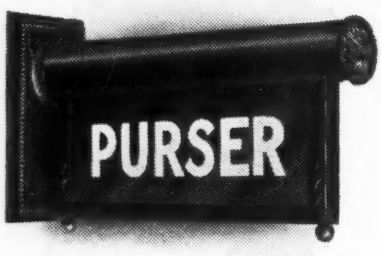

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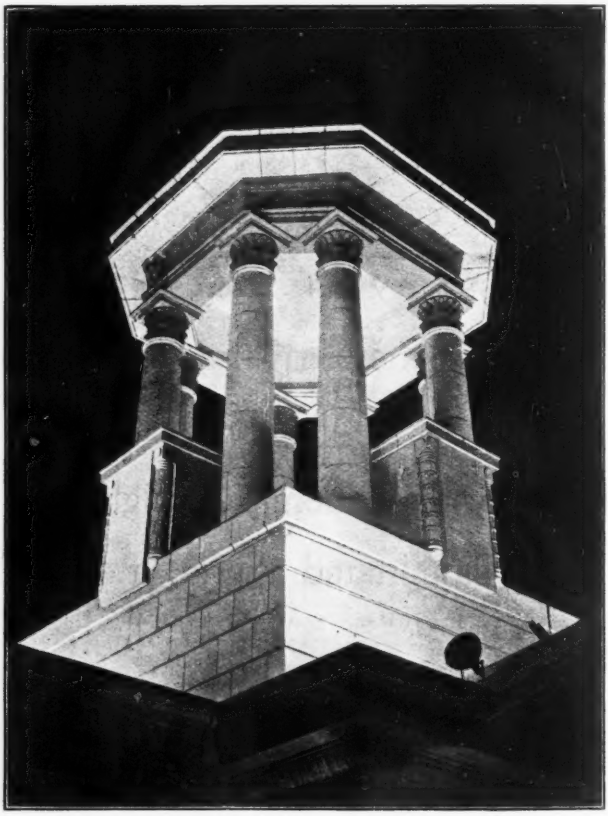

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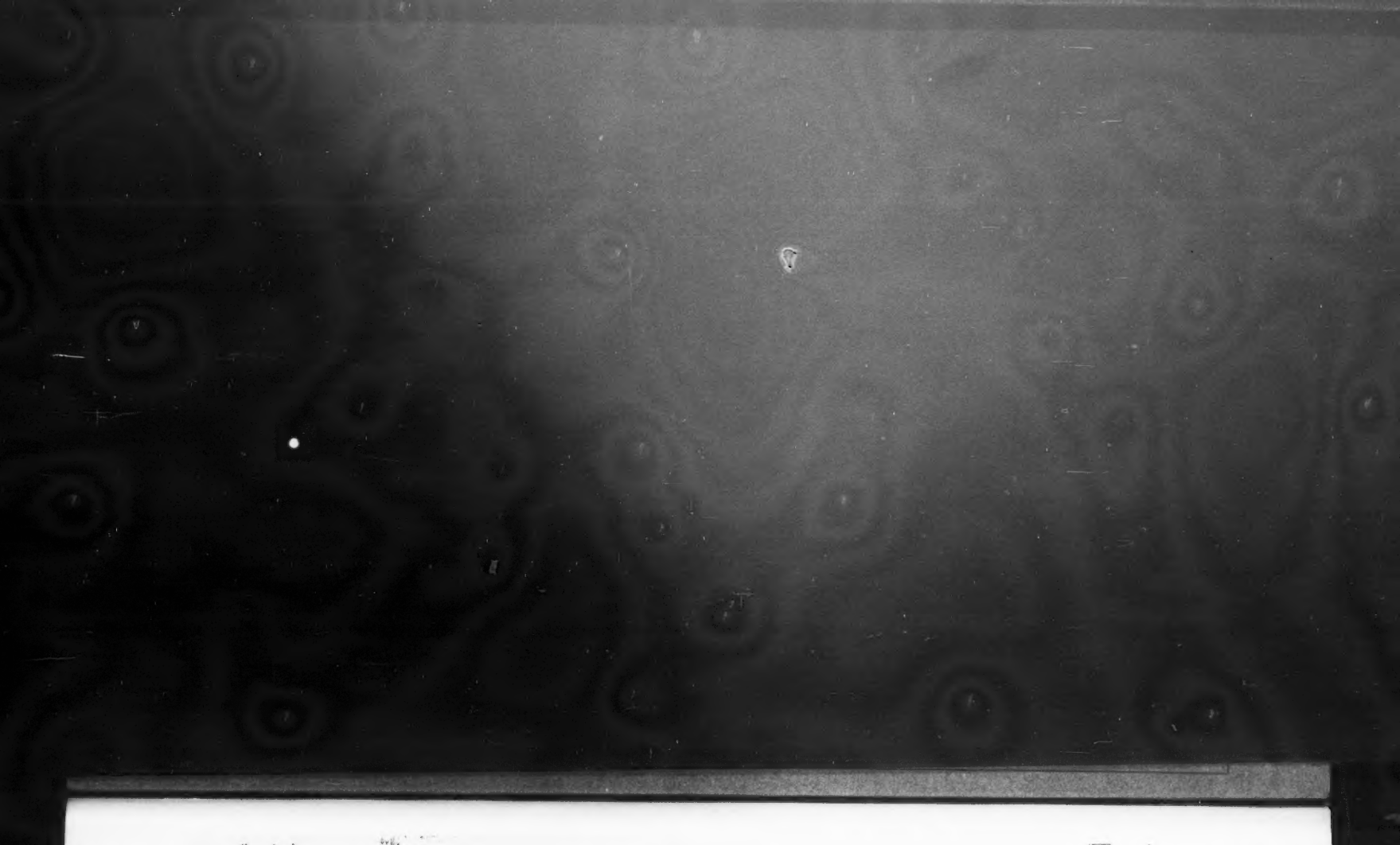

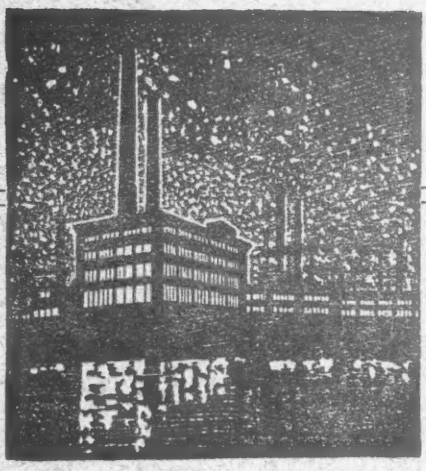

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